*Meteorological observations at Honolulu, May, 1899.*

The station is at 21° 18′ N., 157° 50′ W.
Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.
The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force or amounts of cloudiness, connected by a dash, indicate change from one to the other.
The rainfall for twenty-four hours is now given as measured at 1 p. m. Greenwich time on the respective dates.
The rain gauge, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

| Date. | Pressure at sea level. | Temperature. | | During twenty-four hours preceding 1 p. m., Greenwich time, or 2:30 a. m., Honolulu time, of the respective dates. ‖ | | | | | | | | Sea-level pressures. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Temperature. | | Means. | | Wind. | | Total rainfall. | Average cloudiness. | | |
| | | Dry bulb. | Wet bulb. | Maximum. | Minimum. | Dew-point. | Relative humidity. | Prevailing direction. | Force. | | | Maximum. | Minimum. |
| | * | † | † | | | ‡ | ‡ | | § | | | | |
| 1 | 30.08 | 70 | 67.5 | 81 | 68 | 67.0 | 76 | s-e. | 2-0 | 0.08 | 4-10 | 30.10 | 30.00 |
| 2 | 30.00 | 71 | 66.5 | 82 | 68 | 66.0 | 70 | se-ne. | 0-3 | 0.00 | 3 | 30.08 | 30.00 |
| 3 | 30.06 | 72 | 67 | 83 | 68 | 65.0 | 71 | ne. | 3 | 0.05 | 6 | 30.08 | 30.00 |
| 4 | 30.06 | 71 | 65 | 80 | 70 | 62.5 | 66 | ne. | 4 | 0.00 | 4-1 | 30.11 | 30.03 |
| 5 | 30.05 | 72 | 67.5 | 83 | 71 | 62.7 | 66 | ne. | 3-0 | 0.02 | 2 | 30.10 | 30.01 |
| 6 | 30.08 | 72 | 66 | 82 | 68 | 63.7 | 68 | ne. | 3 | 0.00 | 5-2 | 30.09 | 30.01 |
| 7 | 30.05 | 72 | 66.5 | 81 | 71 | 63.0 | 67 | ne. | 3 | 0.06 | 4 | 30.09 | 30.01 |
| 8 | 30.01 | 73 | 66 | 81 | 69 | 64.5 | 70 | ne. | 4 | 0.08 | 7 | 30.10 | 30.01 |
| 9 | 29.99 | 72 | 66.5 | 82 | 72 | 63.0 | 66 | ene. | 4 | 0.03 | 4 | 30.05 | 29.97 |
| 10 | 30.02 | 72 | 66 | 81 | 70 | 64.7 | 70 | ene-ne. | 3-4 | 0.08 | 4 | 30.04 | 29.97 |
| 11 | 29.98 | 72 | 66 | 80 | 68 | 62.3 | 65 | nne. | 3-5 | 0.00 | 3 | 30.07 | 29.98 |
| 12 | 29.95 | 71 | 64.5 | 82 | 70 | 62.0 | 62 | nne. | 3-5 | 0.00 | 2 | 30.03 | 29.93 |
| 13 | 29.94 | 68 | 64 | 82 | 70 | 61.3 | 62 | nne. | 3 | 0.00 | 2 | 30.01 | 29.90 |
| 14 | 29.96 | 72 | 66 | 81 | 66 | 62.0 | 66 | nw-ne. | 3-0 | 0.00 | 4 | 29.99 | 29.90 |
| 15 | 29.95 | 71 | 66.5 | 82 | 65 | 62.7 | 66 | ne. | 3 | 0.02 | 4-9 | 30.01 | 29.95 |
| 16 | 29.96 | 71 | 66.5 | 83 | 71 | 63.7 | 68 | ne. | 4 | 0.18 | 3-7 | 30.01 | 29.95 |
| 17 | 29.97 | 70 | 67.5 | 80 | 69 | 64.7 | 71 | ene. | 3-0 | 0.30 | 7 | 30.00 | 29.94 |
| 18 | 29.91 | 67 | 66 | 74 | 68 | 68.3 | 88 | w. | 1-0 | 0.86 | 10 | 29.99 | 29.91 |
| 19 | 29.90 | 69 | 67 | 81 | 66 | 66.5 | 83 | sw-w. | 0-2 | 0.00 | 2-8 | 29.96 | 29.89 |
| 20 | 29.91 | 68 | 67 | 77 | 66 | 66.5 | 84 | s. | 2-0 | 0.29 | 10-8 | 29.96 | 29.91 |
| 21 | 29.95 | 71 | 68.5 | 81 | 68 | 65.3 | 81 | se-ne. | 0-4 | 0.01 | 8-10 | 29.99 | 29.91 |
| 22 | 29.97 | 74 | 68.5 | 84 | 67 | 66.5 | 82 | e-ne. | 1-4 | 0.00 | 5 | 30.03 | 29.95 |
| 23 | 30.01 | 73 | 66 | 80 | 73 | 64.5 | 68 | ne. | 5 | 0.04 | 4 | 30.05 | 29.98 |
| 24 | 30.05 | 74 | 65 | 80 | 72 | 62.5 | 65 | ne. | 5 | 0.03 | 5 | 30.09 | 30.01 |
| 25 | 30.03 | 73 | 65 | 80 | 73 | 61.0 | 61 | ne. | 5 | 0.00 | 5-10 | 30.11 | 30.03 |
| 26 | 30.03 | 72 | 66 | 76 | 72 | 61.7 | 66 | ne. | 4 | 0.17 | 10-8 | 30.09 | 30.02 |
| 27 | 30.05 | 72 | 65 | 77 | 71 | 63.3 | 70 | ne. | 5 | 0.20 | 8-3 | 30.11 | 30.02 |
| 28 | 30.08 | 73 | 66 | 78 | 71 | 61.7 | 65 | ne | 4-6 | 0.02 | 5 | 30.09 | 30.03 |
| 29 | 30.05 | 73 | 66.5 | 80 | 71 | 61.5 | 63 | nne. | 5-4 | 0.00 | 3 | 30.09 | 30.02 |
| 30 | 30.10 | 73 | 65.5 | 80 | 72 | 63.7 | 65 | nne. | 5-4 | 0.02 | 6 | 30.14 | 30.05 |
| 31 | 30.08 | 73 | 65 | 82 | 71 | 62.7 | 64 | ne. | 4 | 0.00 | 3 | 30.14 | 30.08 |
| Sums. | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2.44 | ..... | ..... | ..... |
| Means. | 30.003 | 71.5 | 66.2 | 80.5 | 69.5 | 63.7 | 69.5 | ..... | 3.0 | .... | 5.1 | 30.058 | 29.980 |
| Departure. | —0.004 | ..... | ..... | ..... | ..... | 0.0 | —1.0 | ..... | ..... | —0.50 | +0.4 | ..... | ..... |

Mean temperature for May, 1899 (6+2+9)÷3=74.2°; normal is 74.2°. Mean pressure for May (9+3)÷2 is 30.017; normal is 30.021.
*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4:30 p. m., Greenwich time. ‡These values are the means of (6+9+2+9)÷4. §Beaufort scale.
‖Possibly this record is for 9 a. m., Honolulu time.

## MONTHLY REPORTS OF THE WEATHER BUREAU SERVICE IN THE WEST INDIES.

By WM. B. STOCKMAN, Forecast Official.

(The following is an abstract of Mr. Stockman's report for April, 1899.)

So far as general storms are concerned the conditions remained normal throughout the month. The following is a brief résumé of the meteorological conditions at the central station at Havana:

The a. m. barometer, 30.03, and the p. m., 30.01, each appear to be .04 inch above the normal. The highest was 30.22 on the 11th, and the lowest, 29.89, on the 20th. It was somewhat below the normal from the p. m. of the 16th to a. m. of the 22d, inclusive, and from a. m. of the 27th to p. m. of the 30th, inclusive.

The former depression was attended by a wind velocity of 30 miles northwest, and .69 inch of rainfall on the 18th, and .01 inch on the 21st. The latter depression was not attended by rain or high winds.

The following comparisons of temperature and rainfall are made with the ten years (1888–1897) mean, given in Weather Bureau Bulletin No. 22, Climate of Cuba:

TEMPERATURE.

| | Monthly. | 2 a. m. | 4 a. m. | 6 a. m. | 8 a. m. | 10 a. m. | Noon. | 2 p. m. | 4 p. m. | 6 p. m. | 8 p. m. | 10 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° | ° |
| Mean..... | 76.1 | 74.0 | 70.0 | 69.6 | 78.4 | 79.5 | 81.2 | 81.1 | 80.8 | 77.9 | 75.2 | 73.8 |
| April, 1899... | 74.0 | 70.2 | 69.5 | 69.1 | 72.6 | 77.5 | 78.6 | 78.5 | 77.7 | 75.9 | 73.9 | 72.9 |

The average for 1899 is 2.1° lower than the mean, and the average temperature at various hours is from 0.5° to 3.8° lower than the mean at the same hours.

Absolute maximum..... 93.6° in 1895.
Maximum, April, 1899..... 88.0° on the 7th.
Absolute minimum..... 52.9° in 1891.
Minimum, April, 1899..... 62.4° on the 12th.

Showing the maximum and minimum in the month to have been respectively, 5.6° lower, and 9.5° higher than the extreme recorded in the decade.

Rainfall compared with a 10-year period:

Mean..... 1.46 inch.
Total, 1899..... .70 inch.
Greatest..... 5.67 inches in 1897.
Least..... 0.00 in 1896.
Greatest in 24 hours in April, 1899..... .69 inch on 18th.

Number of days with rain.

Mean, 3.8; maximum, 9; minimum, 0. Total, 1899, 2; one with 0.69 inch and one with 0.01, besides which there were 4 with traces, less than 0.005.

The month of April, 1899, shows a departure from the normal of —0.76 inch, and the number of days with rain, .01 inch or more, being about 53 per cent of the average.

In the period 1859–1897, inclusive, the average monthly rainfall is 2.83 inches, and the average number of days with rain, 1863–1897, is 4.6; both amount and number of days with rain being greater than the decade 1888–1897.

For the month of April the prevailing direction of wind is east, and the average hourly velocity is 9.2 miles. April, 1899, gave a total wind movement of 8,219 miles; average velocity, 11.4 miles, and a prevailing direction of northeast, 29 per cent; east being 24 per cent, and northwest, 18 per cent. The percentage of miles was for the northeast 42 per cent; east, 12 per cent, and northwest 22 per cent. The average hourly velocity of wind, 11.4, equals the mean highest average hourly velocity, 2 p. m., as shown by Weather Bureau Bulletin No. 22.

Following is a comparison of the average hourly velocity, with the mean at various hours:

| | Mean. | 4 a. m. | 6 a. m. | 8 a. m. | 10 a. m. | Noon. | 2 p. m. | 4 p. m. | 6 p. m. | 8 p. m. | 10 p. m. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean ..... | 7.5 | 4.3 | 4.5 | 6.5 | 9.2 | 10.7 | 11.4 | 10.7 | 8.7 | 6.9 | 5.6 |
| April, 1899... ..... | 11.4 | 6.4 | 7.0 | 8.2 | 13.2 | 14.2 | 16.6 | 17.3 | 16.1 | 12.9 | 9.8 |

From which it appears that the April, 1899, average velocity, at the several hours, was from 1.7 miles to 7.4 miles per hour greater than the mean, and the higher average hourly velocities occurred at later hours than the higher mean. The highest average hourly velocity for April, 1899, was 17.4 miles at 3 p. m., and the lowest average hourly velocity, 6.4 miles from 2 a. m. to 5 a. m.

The following high winds occurred during the month: 6th, 28 miles ne.; 7th, 30, se.; 8th, 26 nw.; 9th, 27 nw.; 11th, 32 ne.; 12th, 30 ne.; 13th, 33 ne.; 14th, 31 ne.; 18th, 30 nw.; 23d, 30 ne.; 24th, 27 ne.

The possible sunshine for April varies from 12.4 hours on the 1st to 13 hours on the 30th. During April, 1899, the sun

shone 61 per cent of the possible, an average of 7.7 hours per day.

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The following is an abstract of Mr. Stockman's report for the month of May:

No general storms known to have occurred. Certain weak barometric depressions, with slightly increased wind and rain occurred on the 1st, 2d, 3d, and rather high winds occurred at Havana on the 1st, 6th, 7th, 15th, 16th, 17th, 24th, 25th, 29th, 30th, and 31st. None of these winds could be considered as anything but the regular northeast trades, except the squalls of the 1st, 24th, and 25th; the last attended a thunderstorm and heavy rain. No damage was done by the wind.

Hail was reported at Santa Clara on the 26th. On the 21st a whirlwind occurred 12 miles from Pinar del Rio and passed from east to west, doing no damage.

The following comparisons are made between a ten years' (1888 to 1897) mean and May, 1899:

| | Temperature. | | Rainfall. | |
|---|---|---|---|---|
| | 10-year mean. | 1899. | 10-year mean. | 1899. |
| Mean monthly | 78.8 | 76.8 | | |
| Absolute maximum in 1890 | 97.9 | 88.7 | | |
| Absolute minimum in 1889 | 64.4 | 66.1 | | |
| 4 a. m. | 72.7 | 71.4 | | |
| 6 a. m. | 72.9 | 70.5 | | |
| 8 a. m. | 76.8 | 75.7 | | |
| 10 a. m. | 82.8 | 82.0 | | |
| 12 noon | 83.1 | 82.8 | | |
| 2 p. m. | 83.3 | 81.8 | | |
| 4 p. m. | 82.8 | 80.6 | | |
| 6 p. m. | 80.4 | 79.5 | | |
| 8 p. m. | 77.5 | 77.9 | | |
| 10 p. m. | 76.3 | 76.2 | | |
| Mean monthly | | | 5.15 | 1.64 |
| Greatest amount in twenty-four hours | | | 6.27 | 1.35 |
| Average number of rainy days | | | 9.9 | 4 |
| Greatest number of days with rain | | | 16 | |
| Least number of days with rain | | | 3 | |

This table shows that the mean temperature for May was 2° lower than the ten years' normal, the maximum 9.2° lower than the absolute maximum; minimum 1.7° higher than the absolute minimum, and the mean temperature at the selected hours from 0.1° to 3.1° lower than the normal.

The rainfall for the month was greatly deficient, being —3.51 inches from the ten years' normal and —2.83 inches from a thirty years' period. The number of days on which rain fell was but one more than the least recorded in a ten years' period. The average monthly rainfall for a thirty years' period is 4.47 inches, and average number of days with rain 9.3 inches, both of these averages being less than the average for a ten years' period.

*Wind.*

| | Mean hourly velocity. | Annual hourly velocity. | | | | | | | | | | Prevailing direction. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 4 a. m. | 6 a. m. | 8 a. m. | 10 a. m. | 12 noon. | 2 p. m. | 4 p. m. | 6 p. m. | 8 p. m. | 10 p. m. | |
| Annual | 7.8* | 4.3 | 4.5 | 6.5 | 9.2 | 10.7 | 11.4 | 10.7 | 8.7 | 6.9 | 5.6 | e.* |
| May, 1899 | 11.0 | 4.9 | 4.8 | 6.2 | 10.9 | 16.0 | 18.8 | 18.7 | 17.1 | 13.3 | 9.8 | ne. |

* 10-year mean for May.

From the above, it will be seen that the hourly averages for May, 1899, differ from the annual hourly by from —0.3 at 8 a. m. to +8.0 at 4 p. m. With the exception of 8 a. m., all averages are higher, and the high average velocities continued much later in the day. The total number of miles for the month was 8,219.



## THE UTILIZATION OF FOG.

By FORD A. CARPENTER, Observer Weather Bureau, San Diego, Cal.

A cursory examination of our local meteorological conditions is given in a paper in the MONTHLY WEATHER REVIEW for March, 1899, pages 101–102, by Mr. A. McL. Hawks, C. E., Tacoma, Wash., on "The Utilization of Fog." Mr. Hawks says:

I spent March to May, 1898, in San Diego. The country was absolutely arid; no rain of import had fallen in eighteen months, the streams were dry, the huge reservoirs were almost empty, ranches were barren, wheat fields burnt up, cattle driven out of the State, fruit trees dying for lack of water. And yet almost every evening (I think safely three out of five) tons upon tons of water rolled in from the ocean over the land, hung there all night long, only to evaporate in the a. m. with the parched land almost as thirsty as before its visit. The diurnal cycle usually reads thus: at about 10 a. m. a sea breeze springs up, blowing 12 to 20 miles per hour from the west, with the sun shining as it only can shine in the arid countries; at 5 p. m. the breeze falls until by 6 p. m., it is usually gone so entirely that the sailors method of licking a finger to detect the direction of the wind fails to find any stirring. As the breeze dies down a bank of fog forms out over the ocean and rolls shoreward. This is usually about 500 feet deep. And when it strikes Point Loma dashes up into the air like spray from a rock. Long after the wind dies out the fog continues to roll inland until it finally reaches the hills 1,000 to 1,500 feet elevation and 25 to 40 miles inland. Rarely in the evening does it climb to the summit of these hills (2,000 to 3,000 feet elevation), though usually it rolls over them before morning. By 8 p. m. the grass is quite wet; all night long this bank lies over the the land. Soon after sunrise, generally about 8 a. m., the breeze springs up from the west, and by 10 a. m. the conditions are exactly the same as on the preceding day.

To one accustomed to the verdure of a well watered country, San Diego County ordinarily presents an arid appearance. Dependence is placed entirely upon irrigation, the natural precipitation being insufficient for any except the scanty vegetation of the desert. The rainfall of the higher elevations of the country is stored and used when necessary. During the eighteen months preceding March, 1898, in which period Mr. Hawks stated that "no rain of import had fallen," 15.74 inches, or 80 per cent of the normal precipitation had actually occurred. The natural state of the streams in San Diego County is that of dryness, the old joke about the rivers running upside down becomes a verity, as steadily flowing wells near the sunken river beds prove. The farmer accustomed to green looking hay would be shocked to see stock fattening on what appears to be the straw from "wheat fields burnt up." Instead of "cattle being driven out of the State" when pasturage fails on the lower coasts, they are simply moved 10 or 20 miles inland to higher elevations, where the rainfall is from four to five times greater than in the country bordering the coast. Fruit trees growing out of hard clods of sun-baked soil appear truly artificial, but no case of "fruit trees dying for lack of water" has yet come to my notice.

As to the sunshine and the implied high temperature, "the sun shining as it only can shine in the arid countries," I find that in point of fact, the mean of the highest temperatures for the three months was 62° in March, 65° in April, and 63° in May.

As to the strength of the wind, the article is again in error, for the records for the months under consideration, show an average velocity of 10 miles per hour from the sea and 5 from the land.

During this period there were two days with an hour or more of fog in March, six in April, and none in May: total eight. Possibly the memory of one night's fog, that of April 26, 1898, when it was as dense as a moist rain, depositing a trace in the rain gauge and causing the metal roofs of buildings to drip with moisture was indelibly fixed in the mind of the writer of the article: and was also responsible for the reference to fog on "3 days out of 5." There have been instances of deposits of water of 0.01 to 0.05 inch due to fog, but these occurrences are rare, not happening oftener than once